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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/718,320	11/19/2003	Chunyuan Chao	M-15208 US	1058

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EXAMINER

DEO, DUY VU NGUYEN

ART UNIT	PAPER NUMBER
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1765

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/17/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

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Office Action Summary	Application No.	Applicant(s)	
	10/718,320	CHAO ET AL.	
	Examiner	Art Unit	
	Duy-Vu N. Deo	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 October 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 and 34-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 4-10 and 34-40 is/are allowed.
- 6) ☒ Claim(s) 1, 3 and 13-22 is/are rejected.
- 7) ☒ Claim(s) 2, 11, 12, 23-26 and 41 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 3, 13-17, 21, 22, 40 are rejected under 35 U.S.C. 102(e) as being anticipated by Tsai et al. (US 5,753,418).

Tsai describes a method for forming a pattern layer comprising: providing an organic ARC 16 on a silicon nitride layer 14 (claimed the material of ILD) (col. 6, line 25-50); providing a photoresist pattern (claimed organic photoresist) layer including a plurality of first openings on the organic ARC layer (col. 6, line 65-24); etching the organic ARC layer to form a plurality of second openings extending through the ARC layer, wherein the second openings having inwardly-tapered sidewalls such that the bottom width dimensions of the second openings are smaller than corresponding width dimensions of the first openings (col. 7, line 25-40); etching the nitride layer to form a plurality of third openings from the second openings (col. 8, line 18- 30).

Referring to claim 3 the CF₄ would provide etch inhibitors in order to form a taper sidewall in the organic ARC.

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Referring to claims 13-15, the openings (claimed second openings) in the organic ARC layer has an angle of 75-85 degrees, as taught by Tsai (col. 7, line 39, 40) (this would provide claimed the slopes to be at least 4 or more degrees away from the 90 degree vertical slope, or about 7-40 degrees away from a 90 degree vertical slope, or 7-22 degrees away from a 90 degree vertical slope.)

Referring to claim 16, figure 3 shows the contact hole 18 must be anisotropically etched in order to form a straight and vertical sidewalls (claimed the sidewalls of the third openings are not sloped by more than about 3 degrees away from the 90 degree vertical slope).

Referring to claim 17, the etching of the nitride layer (claimed third opening) uses CF_4 , CHF_3 (claimed carbon and fluorine providing components) and helium (claimed inert gas) (col. 8, line 33-50).

Referring to claims 21, 22, the opening in the nitride would have a width of 0.3 μm (col. 8, line 17), which would be at least 10% smaller than the corresponding width dimension of the first opening of 0.35 μm .

Referring to claim 40, the organic ARC layer has a thickness of 500-2500 angstrom (col. 6, line 60-64). This would include claimed 700-800 angstrom.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai as applied to claim 17 above, and further in view of Chou et al. (US 5,968,846).

Referring to claim 18, Tsai doesn't teach the etching gas include CO. Chou teaches a method for etching of the nitride layer using gas such as CO (summary). One skilled in the art at the time of the invention would find it obvious to use CO because Chou teaches that gas mixture including CO is suitable for any plasma etching of the nitride layer to prevent the below silicon layer from over etching (col. 3, line 43-47).

Referring to claims 19, 20, in the absent of unexpected result, using other fluorine-containing component such as C₄F₆, and inert gas such as Ar, would be obvious to one skilled in the art for the etching of the silicon nitride layer.

Response to Arguments and the Declaration

5. Referring to applicant's argument that preamble of claim 1 must be given patentable weight, paragraph (a) of claim 1 makes antecedent only to the "ILD" layer, but not the limitation of "an interlayer dielectric region of a monolithically integrated device" nor "a first and a second conductive layer of the monolithically integrated device". Therefore, the limitation of the interlayer dielectric region is structured to separate a first conductive layer from a second conductive layer of the monolithically integrated device is not given patentable weight. In order for it to have patentable weight, it would have to be presented as a limitation in the body of the claim.

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Applicant's arguments and the Declaration by Ching-Hwa Chen that Hui doesn't teach or suggest to use organic material for the ARC is found persuasive. There rejection under Hui and Tsai has been withdrawn.

Applicant's argument that Tsai doesn't teach or suggest the method can achieve smaller dimensions such as no more than 0.2 μm (claim 11), 0.18 μm (claim 12) is found persuasive.

Allowable Subject Matter

6. Claims 2, 41, 11, 12, 23-26, 38, 39 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 2, 41 are allowable because applied prior art, Tsai, doesn't teach the first conductive layer is part of an active layers set and wherein the second conductive layer defines a first major interconnect layer above the active layers set.

Claims 11, 12 are allowable because applied prior art, Tsai, doesn't suggest or teach that the method can achieve a third openings to have a bottom width dimensions of no more than 0.2 or 0.18 μm . He teaches to achieve a 0.3 μm dimension.

Claims 23-26 are allowable because applied prior art, Tsai, doesn't suggest the limitations of using a predefined photo mask to define width dimensions of the first openings; and using the same predefined photo mask to manufacture additional monolithically integrated devices each having a respective version of said ILD region, of said photo resist layer and of said ARC layer with inwardly-tapered openings, but where at least two of the monolithically integrated devices that are manufactured by

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use of said same predefined photo mask have substantially differently dimensioned widths for their corresponding, third openings extending through their corresponding ILD regions and have substantially differently dimensioned widths for their corresponding, second openings.

Claim 38 is allowable because applied prior art, Tsai, doesn't teach the ILD include the silicon-oxide based insulator having a thickness of 0.1 um or more.

Claim 39 is allowable because applied prior art, Tsai, doesn't suggest or teach the thickness of the photoresist layer of about 6.1 um or less.

Claims 4-10 remained allowed as indicated in the final action.

Claims 34-37 are allowed because applied prior art doesn't suggest the step of filling the substantially vertical contact holes with an electrical conductor.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Duy-Vu N. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Duy-Vu N Deo
Primary Examiner
Art Unit 1765

1/8/07

